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ABSTRACT

The Zimbabwe Secondary School Science Project (ZIM-SCI) was started in 1981 with the aim of developing a low-cost science course which could be taught during the first 2 years of secondary school without the aid of qualified teachers and conventional laboratories. Project activities included developing student study guides, corresponding teaching guides, and science kits, implementing and evaluating the course, and other efforts to meet the need for a truly scientific science curriculum in a third world context. This report focuses on project activities that took place during 1983. Since circumstances and objectives changed as the project developed, the report attempts to: (1) review overall progress in light of the original conception; (2) examine weak points in the system and strategies devised to strengthen them; and (3) to map out possible lines of development for the future. Among the general areas considered are: implementation efforts; production and distribution of printed materials; establishment of science centers; inservice courses; evaluation; examinations; communication with teachers; staffing; finance; and syllabus development. A list of national and general aims of the project and a copy of the 1983 Zimbabwe Junior Certificate Examination (which ZIM-SCI students currently take) are included in appendices. (JN)

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THE ZIM-SCI PROJECT

Progress Report No. 2 December, 1983.

1. Preamble:

1.1 The previous progress report on this Project covered the period from the inception of the project in January, 1981, to the end of 1982. This report will cover developments during 1983.

1.2 However, as the Project has developed, so have circumstances and objectives changed, and in this report there will also be attempts to review overall progress in the light of the original conception; to examine weak points in the system and strategies devised to strengthen them; and to map out possible lines of development for the future.

1.3 No attempt will be made to separate these themes. Reference will be made to past, present and future possibilities where appropriate, in order to give a comprehensive picture of the state of Zim-Sci at this time.

1.4 The end of 1983 represents a watershed for the Project. Delivered to the printers this month is the manuscript for the final unit of the Junior Certificate Integrated Science Course. With publication of this unit the project team has achieved the goal set at the beginning of 1981, i.e.: of creating a low cost science course for the first two years of secondary school which can be taught without the aid of qualified teachers and conventional laboratories.

1.5 Eighteen Study Guides and nineteen Teachers' Guides containing about half a million words, about one thousand diagrams and pictures have been written and produced in large numbers.

1.6 Three low cost apparatus kits have been designed, assembled, and distributed to 680 schools involved in the scheme.

1.7 A system which attempts to sustain these materials and maintain communication between classroom teacher and the development team, has gradually been constructed. While not without weaknesses the system is one which is fundamentally logical and capable of becoming stronger as manpower resources and bureaucratic efficiency improve.

1.8 Zim-Sci is no longer an experimental project. It exists ipso facto as the major contributing agency to mass science education in Zimbabwe. As such, it is vital that development work continues both in the refining of what has already been accomplished and in the creation of new materials for Years III and IV.

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2. Cooperation between the Ministry of Education and Culture and the University of Zimbabwe.

2.1 The project had its origins in research which was undertaken in the then Science Education Centre of the University of Zimbabwe and copyright for the materials produced continues to be shared between the Ministry and the University.

2.2. The Project is still accommodated in three offices and a laboratory made available by the Faculty of Education through the Department of Curriculum Studies.

2.3. Because of the increasing complexities of the project, major areas of strain have developed over its day to day administration and structure. These areas can be defined under three headings: 1: The role and status of the project leader; 2: accommodation; 3: administration and finance.

2.31 Project Leader's Role
In the early stages of the project the team enjoyed virtually complete autonomy in the development of materials, the ordering of apparatus items and, through the project leader, day to day administration. As the project matured, pressures were imposed on the project leader from both the University and the Ministry of Education and Culture.

2.311 On the one hand the University exerted pressure for resumption of the teaching duties from which the project leader had been released, and on the other hand the Ministry demanded greater involvement of the project team in Ministry activities and a greater degree of control in policy and day to day administrative decisions.

2.312 In an attempt to neutralise the first pressure it was agreed that, while leaving his status and conditions of service unchanged, the Project Leader's salary would be paid from the Project fund, thereby releasing University funds for the engagement of a temporary lecturer to take up the teaching duties already mentioned.

2.313 The second pressure has been partly neutralised by an increase in consultation with the Chief Education Officer SEDU (Secondary Education Development Unit) and her deputy. Contact with the other subject teams in SEDU has also helped to ensure a smoother coordination. Considerable benefit has flowed from these contacts particularly between the Zim-Sci team and those for Agriculture and for Technical subjects.

2.314 However, in spite of repeated pleas for clarification, the role of the Project leader remains undefined and his areas of control unclear.

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2.315 The most recent evaluation report (see Bajah Report p88 and section 8) takes note of this problem and suggests some form of steering committee might provide a structure which would satisfy the needs of Ministry and University for overall supervision, while allowing the Project Leader the degree of autonomy essential for the effieicnt running of the Project.

2.316 I would very much welcome this solution: The establishment of a defined membership for such a committee, and terms of reference for its operation, would largely meet my need as Project Leader for a formal structure and clearly defined role.

2.32 Accommodation

As has already been stated the Project is accommodated at the University. Office accommodation is at a premium in the Faculty of Education wh!'e the demand for teaching space is acute at certain periods of the year.

2.321 Consequently the Facu!ty has been unable to extend the office space available to the team and the laboratory space must be vacated whenever students are in for science courses.

2.322 The regular loss of the laboratory space, being the main research and development room for the Project, for two weeks three times a year, causes considerable disruption in the creative work of the team.

2.323 The room is normally occupied by three writers and the artist and at any time may have two more writers working at the benches. While the Faculty makes alternative accommodation available for these teaching periods, it is impossible to move the 'development kit'and other resources into the temporary offices.

2.324 It is hoped that the proposed Curriculum Development Centre being built for the Ministry of Education will eventually provide a permanent base for the project, but that is not likely to be available until the end of 1984 at the earliest.

2.33 Administration of Finance.

Some aspects of difficulty in the administration of the project have already been referred to. The problem which has arisen is over the administration of what is referred to in the SIDA Project Document as "Research Development Evaluation and Training" which was originally conceived of as the "working fund"for the project.

2.331 As such it was separated from the main funding for equipment and materials and placed under the control of the University Bursar's department, to be administered by the Project Leader.

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2.332 This arrangement has proved very satisfactory for the past three years, but recently the Chairman of the Department of Curriculum Studies has indicated that he wishes to have control of these funds.

2.333 Because of the Chairman's lack of detailed knowledge of the project and his preoccupation with other more immediate duties, I foresee relatively simple decisions on the hire of occasional secretarial assistance, travel arrangements and requirements for development materials, being severely delayed with a consequent effect on the creativity and morale of the team.

2.334 To date this controversy remains unresolved. One solution might be regular reports on expenditure to the "Steering Committee" already suggested under para. 2.315 in addition to the annual statement of expenditure already drawn up each year (See section 13 and appendix 8).

3. Implementation

3.1 The number of schools involved in the Project contine to increase and during 1983 a further 60 Year I kits and sets of printed materials were issued.

3.2 In addition to this increase in total numbers each previous year group received the next kit required in progression and resupply kits for consumable materials were issued to those schools where Form I and Form II classes had been established. (See appendix 1).

3.3 The production of these various kits has come up against a fundamental problem of inadequate planning information. The problem has been exacerbated by the growing interest of conventional schools (i.e. those well established schools with laboratories and some conventional apparatus). The problem has three facets of increasing difficulty:

3.31 Requests for Zim-Sci printed materials only, come from schools where the supply of equipment and consumable materials is deemed adequate, but because of the lack of trained science teachers the Zim-Sci study materials become appropriate. In most cases these requests can be met from surplus stocks held by the E.O. Science in each region.

3.32 Requests for printed materials and some items of Zim-Sci equipment e.g. solar cells, force meters and bioviewers. While printed materials can be supplied, the project carries very little in the way of "shelf stock" and therefore cannot normally supply individual items to schools. Because of foreign currency limitations, imported items are not stocked by commercial suppliers either.

3.321 However, an increasing proportion of Zim-Sci equipment is being manufactured locally, and manufacturers often have small excess quantities available for sale to individual schools.

3.33 The annual increase in the number of schools involved in the Project depends largely on decisions within the planning sector of the Ministry of Education and Culture. Tender procedures, foreign currency transfers for purchase of imported components, manufacture of local items, and assembly of the kits, takes, in our experience, a total period of at least 6 months and therefore we need to know approximate numbers by May/June of the previous year.

3.331 Unfortunately, accurate information has not been available at that time over the past two years from planning departments, and a "guesstimate" is arrived at by discussions with planning department officials and the Regional Education Officers (Science).

3.332 This has proved generally satisfactory in meeting the major demand for complete kits in the forthcoming year, but inevitably requests from conventional schools and newly established local authority schools come in, usually in January/February of the year in question. These additional kits cannot be supplied until orders are prepared for the following years with consequent dissatisfaction and disappointment in the schools.

3.333 The solution is obviously to over-order but is difficult to achieve judiciously when the basis is itself a "guesstimate".

3.334 The real answer is more definite information from planning and it is hoped that as the education system stabilises this data will become available early enough to provide a reliable basis for planned growth.

3.34 A start has been made in a recent C.E.O. (SEDU) circular to schools inviting conventional schools to make application for Zim-Sci equipment and printed materials for purchase against their normal allocation of funds. Unfortunately it will not be possible to meet any requests received as a result of this exercise until late in 1984 and then only if the Ministry can make the necessary funds and foreign currency available to cover the orders in the near future.

3.4 Resupply kits.

As indicated in para. 3.2 replacement of consumable materials is done through resupply kits. This policy enables chemicals etc. to be ordered in bulk at advantageous prices.

3.41 While the provision of equipment and initial consumable supplies has been the object of the SIDA funding, I strongly believe that responsibility for the resupply of worn out items and chemicals, etc., should be that of each individual school.

3.42 Implicit in this suggestion is the need to provide 'shelf stock' in the Zim-Sci distribution centre to meet requests from schools for individual worn out, broken or stolen items.

A start has been made this year in over ordering 'basic kits' as feedback from schools suggests that the original basic kits will require part replacement during 1984.

3.43 If the advantage of centralised bulk purchase and annual distribution is to be retained, these developments would require the Ministry to make provision for purchase and then reimbursement from school equipment votes.

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3.44 I have had initial discussions with the Ministry on this topic and hope that such a system can be established intime for the ordering, in 1984, of resupply kits for 1985.

4. Production of Printed Materials.

Eight units of study materials (study guides and teachers' guides) were produced in 1983. Six of the units completed the material for the J.C. course, which consists of 18 units, and the remaining two are the first units in the O-level General Science course.

4.1 In addition to the study units, four revision questions books were produced. The books are designed to provide teachers with additional test material for use in internal examinations and the revision run-up to the J.C. science examination.

4.2 Liaison with Audio Visual Services in the Ministry of Education resulted in the design and production of a Periodic Table classroom chart. This chart is intended for use in the O-level course. While produced for the Zim-Sci course, it is of general applicability and has been printed in sufficient quantities for it to meet the needs of all schools teaching chemistry.

4.3 During last year and the early part of this year, the Project encountered serious delays in the printing of materials by Government Printers. This was not due to any lack of cooperation from Government Printers, where we have always received the best advice and assistance, but was due to an increase in demands for their services from other Ministries and to loss of staff.

4.4 After discussion with Government Printers it was agreed that they would continue to produce reprints of previously published materials, while new units would be put out to commercial printers.

4.5 I prepared a schedule for the writing of the remaining units of the J.C. course and the complete O-level course. This schedule became the basis for a tender issued by the Ministry of National Supplies and eventually went to Irwin Press of Harare.

4.6 The first two or three units produced commercially were printed and ready for distribution within two weeks of delivery of 'camera ready' copy to the printers. Recent units have encountered some delays due to problems within the origination department of the printers, but it is hoped these problems will be surmounted in the new year.

4.7 The print run for study guides is currently 70 000, while that for teachers' guides is 3 000. The reprint run is 30 000. Reprints are used for new schools and replacement purposes. (Units, printed on newsprint, are estimated to have a working life of 2-3 years). While it may appear wasteful to replace materials after 2-3 years, in fact it is still cheaper than the alternative of durable production on good paper with stronger binding as 'text books'. Text books have an estimated working life of 5 years and are at least four times as expensive as the project's newsprint material, page for page.

5. Distribution

The development of teaching materials and apparatus kits has little impact unless there is an efficient distribution and resupply system.

5.1 The supply and distribution system which has evolved as part of this Project has grown in magnitude and complexity since the initial stage when the writers themselves packed kits and manhandled them into trucks for dispatch!

5.2 The system has developed two main branches, one for the printed material and the other for apparatus and consumable materials.

5.3 Printed materials are dispatched directly from the Printer (either Government or Commercial) to the Regional Education Officer according to a schedule which we issue at the beginning of each year.

5.31 The surplus of each print run is stored at the Zim-Sci Distribution Centre for issue as an 'as required basis' usually in answer to a request from an E. Officer Science.

5.32 Some complaints have been received about the durability of the packing material used by the printers, but other than this minor problem, the delivery service to the Regional Offices appears satisfactory. However, major problems are encountered from this point on.

5.33 The first of these, which has been raised in previous years, is that of adequate regional storage. Most Regional Offices operate out of a number of subject offices and this is little or no provision for the bulk storage of printed materials.

5.331 While each delivery is in the nature of a 'through-put' intended for immediate delivery to the schools, there is always a period which can be days and even weeks before the final distribution is arranged by the E.O. Science.

5.332 An associated aspect is the need to maintain some stocks at regional level to meet unplanned needs for new schools, replacements etc.

5.34 A variety of arrangements are employed by regional offices for distribution of printed materials to schools. These range from physical delivery by the E.O. himself where petrol and and transport allow, to a circular to schools placing responsibility with the school or district authority.

5.341 Feedback from schools suggests that a significant number of them have not been receiving units as quickly as they are produced. Slowness of delivery is not confined to the rural schools and a number of peri-urban schools have been affected.

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5.342 I feel the problem is best solved by the schools themselves and the key to this solution is adequate and immediate information. A brief circular from the E.O. Science announcing arrival of the latest unit is already the norm in some regions and could be with advantage extended to all. The inclusion of such an announcement in the weekly Zim-Sci radio programme is planned but is of doubtful assistance, since Radio 4 coverage is at present patchy.

5.35 While this problem is expected to be greatly reduced for the J.C. course, now that production of units is complete, the same problem will hamper the delivery of the O-level course unless some action is taken by Regional Education Officers (Science).

5.4 The supply and distribution of apparatus and consumable materials is a much more complex problem and its solution would have a very significant effect on the acceptance of the project.

5.41 Year kits contain upwards of 200 items which come from a variety of sources within and without Zimbabwe.

5.42 An attempt in 1982 to place responsibility for assembly and distribution of the kits in commercial hands was unsuccessful and for 1983 it was decided to place responsibility for the assembling and distribution of kits in the hands of the Zim-Sci officer with the focus of operations at the Zim-Centre in Cranborne, Harare.

5.43 At this point I must record my appreciation of the dedication that Mrs. M.A. Lobb, the Administration Officer, has given to the establishment of this assembly and distribution system. Given the delivery of individual items to the Centre before or at the beginning of the year, I am sure kits would reach schools in good time as a result of the extremely efficient work carried out under her direction.

5.44 This key element of supply is, however, very slow. The chief delays are encountered not in local manufacturers or the shipping of imported items, but in the local bureaucratic steps required before orders can be activated by suppliers.

5.45 To quote an example, the following data indicate the progress of the equipment order for 1984:

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5.45 (continued)

1. Submission of our requirements to the Tender Board — July 1983
2. Closing date of tenders — 15.8.1983
3. Letter from Tender Board to suppliers awarding certain items of Zim-Sci equipment (6firms in all) Ref: B/5/6/238 — 30.9.1983
4. Letter from Botswana Government to Ministry of Education placing order for 29 Zim-Sci kits — 8.9.1983
5. Letter from Zim-Sci to all six tenderers requesting foreign currency requirements for NS/EDU/3/83 — 3.10.1983
6. Memo from Miss. H. Benoy to Mrs. Lobb confirming this order. — 18.10.1983
7. Letter from Zim-Sci to the 6 successful tenderers informing them of an increase in original order, requesting new foreign currency requirements. — 18.10.1983

   (The tender No. NS/EDU*3/83 held up in order to include increase of 30 kits for Botsawna Government).

8. Letter from Zim-Sci to Ministry of Finance asking for urgent letter to be written to Svenska Handelshanken in Stockholm advising them of our foreign payment requirements. This letter contained detailed schedule of the six local firms' overseas agents, banks and bank account numbers, plus the amount of money to be paid. — 31.10.1983
9. Letter from Ministry of Finance advising us that this matter is in hand. — 29.11.1983

5.46 A similar pattern for the 1983 order with the consequence that delivery of new kits and resupply kits for 1983 has only recently been completed - nearly a year late!

5.47 In spite of the delays described in para. 5.45 above for the 1984 orders, it is hoped to get kits into the schools by mid February.

5.48 Delivery of overseas orders has begun and the first items are already in the Customs Warehouse. Local items are coming in and locally manufactured items are expected in mid January.

5.5 Recent evaluation reports (Brown June 1983 and Jajah September 1983) emphasise the importance of efficient supply and distribution. Improvements in this area must be a major target for 1984.

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5.6 This is a critical stage in the development of the Project. The system has grown too large to be the responsibility of what is in fact a curriculum development team.

5.61 The overall responsibility for the mechanics of supply and distribution must be recognised as that of the Ministry of Education and Culture's "Supplies Branch".

5.62 The full assumption of this responsibility will probably require additional personnel and facilities to be established within that department. In the past it has operated largely as a clearing house for customs documents and invoices. In this new role it would need resources for the physical handling and storage of equipment and other supplies.

5.63 The expansion of this department would, I feel, be timely, not only for Zim-Sci, but also for the other subject areas of the curriculum whose development teams are likely to be making similar demands in the near future.

5.7 Finally, under this section, I must make mention of the Zim-Sci Distribution Centre. The Centre was established in an old, condemned warehouse last year. Its facilities are meagre but essential: A nearly rain-proof roof, lock up doors and a security fence.

5.71 It has no electricity and some areas are impossible to work in without artificial lighting. At times there is upwards of $100 000 of equipment stored in the Centre, but I have been told by the Ministry that it is not possible to provide night security guards.

5.72 Parts of the Centre have been given over to the Regional Offices of Harare and Mashonaland to fill their need for storage facilities.

5.73 It is a matter of commendation that in two years of operation no materials have been stolen, damage due to rats and rain have been kept to a minimum and materials have been assembled and despatched with the minimum of delay once individual items have been delivered.

5.74 I am grateful to Mrs. Lobb and her store assistant Mr. E. Jamela for this record.

6. Establishment of Science Centres

Progress Report No.1 recorded the establishment of the first service centre in Bulawayo, Matabeleland Region. The success of the Centre established by the Matabeleland Education Officers has prompted other regions to consider setting up similar centres.

6.1 Mention has already been made of the use made by the Harare and Mashonaland Regional regions of parts of the Zim-Sci Distribution Centre. At present this use is confined to storage, but potential certainly exists for the running of small in-service courses, apparatus repair etc. as is done in Bulawayo.

6.2 Recently it was announced that Manicaland has also set up a science centre to bring the total number of potential centres to four.

6.3 It is hoped that the E.O's of Masvingo and Midlands Regions will emulate their colleagues and establish science centres in those Regions early in the new year.

6.4 Apart from the storage and distribution functions such centres can provide a growth point for other science related activities and a focus for joint projects with agriculture and other technical subjects.

7. Courses

As in previous years a three day course was run during the April school holidays and repeated in each region. The course followed a similar pattern to that established in 1982. Several points are of note:

7.1 The number of teachers who attended each course were as follows:

Harare/Mashonaland	120
Manicaland	75
Masvingo	100
Matabeleland	56
Midlands	85
	436

7.2 The majority of course participants were coming to their first course, indicating a continuing rapid turnover in Zim-Sci teaching staff.

7.21 The internal evaluation exercise carried out during 1983 (see Brown June 1982) also showed that of the 173 teachers questioned more than 95% had been teaching science for less than three years.

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7.22 Many of the Zim-Sci teachers are O-level students from 1982 who are unable to find other employment. Some have made application for career employment or further education. This type of teacher accounts in part for the mobility of Zim-Sci teachers.

7.23 Other reasons expressed to us in feedback sessions are transfers to other subjects or promotion posts in the primary sector.

7.24 The main reason, however, is still the lack of a recognisable career structure for untrained and unqualified teachers within the Ministry system. While the annual Zim-Sci course is a useful orientation and contact line between teachers and the development team, it confers no official status on participants for advancement purposes.

7.25 I feel very strongly that the initiative lies with the training colleges who should extend their role to the in-service area. The availability of a standard qualification would stabilise the teaching population to the great long-term benefit of the teaching profession and of the country.

7.26 The problem which will arise of finding money to pay the extra to qualified teachers can be anticipated and allowed for in the annual budget. It should not be seen as an obstacle to the desired advancement.

7.3 The 1983 Zim-Sci courses reflected these increasing pressures for career prospects. In response to requests from participants, approximately one-third of the course was devoted to 'content' material. That is, scientific concepts which give teachers a more comprehensive knowledge of the material covered in the Zim-Sci course units, enabling them to answer pupil questions not covered in the study units, and play a more central role in the classroom.

7.31 A course certificate was also produced and received by teachers with satisfaction as a record of attendance.

7.4 The trend towards scientific content was also reflected in the December course run by the Zimbabwe Teachers' Association in association with the Canadian Teachers Federation.

7.5 If these pressures from teachers are responded to, the transition from 'classroom administrators' of what are mainly self-study materials to fully fledged teachers, will be gradual and result in a competent and enthusiastic teaching force.

8. Evaluation.

There were two major evaluation exercises carried out on the Zim-Sci Project during 1983.

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8.1 The basic aim of the first of these evaluations were as follows:

1. an accurate reflection (from class records) of the amount of time taken to complete each unit.

2. teachers' assessment of the value of ZIM-SCI as a method of teaching science.

3. assessment of the content and usefulness of the Teachers' Guide and Study Guide accompanying each unit.

4. ideas from teachers on how to improve the effectiveness of the ZIM-SCI method - both in content and presentation of the material.

5. suggestions from teachers on ways of improving links between themselves and curriculum developers.

8.11 The responses to the questionnaires sent to teachers may be summarised under the same headings, as follows:

1. The mean time taken per study unit appears to be approximately four weeks, suggesting the course of 18 units can be completed in 72 weeks. This is satisfactory since the course is spread over two years, or 5½ terms of about 13 teaching weeks, leaving about 4 weeks for final revision work.

2. A majority of teachers interviewed (74%) indicated that the Zim-Sci method is effective, does not restrict them unduly (80%) and generally makes science teaching easy for untrained teachers (87%).

3. Teachers considered the content and usefulness of the printed materials as adequate, although, again, their responses indicated a need for more background information to supplement their own knowledge.

4. & 5. The main responses under these headings were for more efficient and rapid distribution of materials and equipment and more courses.

8.2 The second evaluation carried out during 1983 was conducted by Prof. S.T. Bajah of the International Centre for Educational Evaluation, University of Ibadan, and was therefore an external evaluation of the project.

8.21 The scope of the evaluation covered four areas: perception of key personnel, critical examination of the Zim-Sci teaching package, Zim-Sci at work, and Academic achievement.

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8.22 Prof. Bajah's report is lengthy and complex and interested persons are referred to the report itself for detailed results.

8.23 In this report I shall confine myself to quoting six of his final conclusions:

1: Bajah p.85 No.8

"Zim-Sci pupils are enthusiastically learning science which they hope will be useful to them in later life."

2: p.85 No.11

"There is a strong support for Zim-Sci by the Minister of Education and Culture and a good proportion of his staff".

3: p.85 No.13

"The present approach adopted for sending Zim-Sci materials to schools needs some reconsideration and improvement".

4: p.86 No.16

"Zim-Sci printed materials are of reasonable quality in terms of the scientific facts they contain".

5: p.86 No.18

"The performance of Zim-Sci schools in the 1982 JC Examination seems to be good".

6: p.86 No.19

"In comparison with the non Zim-Sci schools the Zim-Sci schools have performed reasonably well".

8.24 A summary of the costs of this evaluation exercise are available in the appendices to this report.

8.3 The Ministry of Education and Culture has established an Evaluation Unit within the Department of Planning and this Unit is currently designing a comprehensive evaluation exercise for 1984.

8.31 A number of objectives for the Zim-Sci Project have been agreed upon by this Evaluation team and the Project team and the 1984 evaluation will centre on these. A list of these objectives will be found in the appendices to this report.

8.4 While evaluation is always valuable, I feel that at this stage consideration should be given to the findings of the five previous evaluation studies, and their recommendations implemented where finance and manpower will allow.

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9. Examinations

Zim-Sci pupils have now taken the national Junior Certificate Examination in Science in 1982 and 1983. The 1983 paper can be found in the appendices.

9.1 While results for the 1983 examination are not yet available, results for 1982 were very satisfactory.

9.11 A survey of pupil results obtained from teachers at the April courses show that more than 70% of pupils who took the examination passed.

9.2 Early impressions obtained by assisting in the marking of the 1983 exercise paper suggest a wide spread of marks with some schools performing satisfactorily and others showing very poor results.

9.21 A new feature in the examination appears to be a deteriorating standard of comprehension in English. There is a pattern of inability to understand questions in some schools, and a fairly widespread difficulty in expressing the science they know by many children.

9.22 If this trend continues, care will need to be taken to phrase papers in the simplest possible language, perhaps making greater use of pictures and diagrams, if a situation is to be avoided in which the examination results reflect candidates' knowledge of English rather than of science.

9.23 The use of multiple choice questions with their subtle use of language to construct efficient distractors is thrown into question by this problem. My own feeling is that this examining technique, with its many advantages, can be retained if emphasis is shifted from subtleties of language to difference in scientific content expressed in diagrams etc.

9.24 Since cassette machines are part of the Zim-Sci kit from 1984 it may also be possible to give a verbally dictated examination to support a printed paper which might greatly reduce the language problem.

10. Communication with Teachers.

During 1983 the Zim-Sci team has continued to make weekly broadcasts during term time to teachers via the Teachers Magazine Programme on Radio 4.

10.01 I am very grateful for the ready cooperation we have received from Audio Visual Services in this context and the patience shown by Mr. D. Gardiner and his staff in the preparation of the weekly recordings.

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10.02 The radio broadcasts have the major advantage of immediacy (they are broadcast the week following recording). But as mentioned elsewhere in this report, there is some doubt as to whether the programmes reach the majority of teachers because of technical difficulties in the broadcast system.

10.03 It would be of considerable advantage to all users of this programme if a comprehensive survey of listener response could be carried out during 1984.

10.1 While not of comparable immediacy the Zim-Sci page in Teachers Forum continues to be the main avenue of regular contact between teachers and the project team.

Use is made of this medium to give teachers details of syllabus changes, apparatus ideas and other practical issues which arise from teachers letters.

10.11 Mrs. J. Beach and her editorial team at Teachers Forum are very cooperative in accommodating a Zim-Sci page which is sometimes half a page and often two or more. I am grateful for the assistance and patience we have received from that team and for their sometimes elastic deadlines!

10.2 Recent evaluations (particularly Brown) indicated that teachers felt a gap remained in communication. In an attempt to fill this gap a newsletter has been introduced on an approximately monthly basis. Addressograph plates for each school have been prepared and the newsletter is prepared and despatched directly from the project.

11. Contact with other SEDU Teams.

The establishment of weekly meetings between the various curriculum development teams by the Head of EDU has greatly reduced the atmosphere of isolation in which the Zim-Sci project has been working.

11.1 Discussions with the Agriculture team has enabled certain subject areas to be shared with consequent decreases in content load and beneficial integration of subject areas.

11.2 Discussions are also taking place with the technical subject team which I am sure will be of great value in the development of the new third and fourth year materials.

12. Staffing.

This year has been a period of relative stability in terms of project staff. Only one member of the team has left for other employment and we have gained two more writers.

12.1 Mr. Martin Udwin joined the writing team in December 1982 and Mr. George Mandizha joined us in January 1983. This brings the writing team to a total of five. (Mrs. B. Hosking, Mr. K. Chidume, Mr. S. Simango, Mr. M. Udwin and Mr. G. Mandizha.)

... / 17

12.2 The only major loss of staff during 1983 has been the resignation of Mr. Gift Jambaya, the project artist since its inception. Mr. Jambaya was instrumental in establishing a characteristic illustrative style for the Zim-Sci materials and the designer of the Zim-Sci logo. His clear and concise diagrams have played a major part in helping children to understand the content of the study guides and the 'old man' who first made an appearance in Unit B and thereafter popped up in a wide variety of contexts became a standing source of amusement for the team! His contribution to the project has been of great value.

12.21 For a period of several months we employed artists on a piece-work basis but found the arrangement generally unsatisfactory.

12.22 It became very obvious during this period that it is essential for the artist to be in constant contact with writers if the diagrams and pictures produced are to convey the information in the mind of the writer.

12.23 Accordingly I decided to seek a full-time artist as a member of the team and after consultation within the team and interviews conducted through the University personnel appointment system, Miss. Margaret Robertsonwas appointed in November. Miss. Robertson is a teacher as well as an artist and is bringing fresh insight to the perceptual problems which may be encountered by children learning from Zim-Sci materials.

12.3 A similar pattern of part-time assistance bedevilled the secretarial section of the project team until the appointment of Mrs. Mary Haywood in August.

The aquisition of a photo-copier, shared with the department of Curriculum Studies, has greatly speeded up the assembly and paste-up stage of production and its reduction facility enabled better quality diagrams to be prepared.

12.4 Mr. Udwin and Mr. Mandizha, while experienced teachers, were both new to the business of writing teaching materials. As for previous members of the team in this position, they both took some time to feel their way with the Zim-Sci style and to acquire the skills needed to write "live" teaching.

12.41 I am conscious of the fact that no member of the Zim-Sci team has received any formal instruction in these skills of distance teaching. While actual experience may be the best teacher, I am sure benefits would accrue from attendance at a short course designed to teach the basic skills and introduce writers to techniques for presentation which have evolved in various distance teaching institutions.

12.42 While in Sweden I learned of the existence of such a course, offered by the Swedish Distance Teaching College, Liber Hermods, for participants from the third world.

I hope that during 1984 it may be possible for some Zim-Sci writers and perhaps others from sister subject teams, to attend this course or a similar one.

... / 18

12.5 It would be remiss of me if I did not conclude this section of my report by recording the dedication, hard work and loyalty shown by the Project team in 1983. In a project of this magnitude and complexity, areas of dissention and friction, between the team and individuals and organisations do happen. I am grateful for the constant support and loyalty I have received from the team members when these situations arise.

13. Finance.

The Project continues to enjoy the genersou support of the Swedish International Development Authority (SIDA).

13.1 Problems in the administration of funds have already been referred to under sections 2 and 3 of this report and will not be repeated here.

13.11 I would only reiterate my opinion that as the project matures it is vital for a system to evolve, within the Ministry, for the administration of equipment funds; the recording of reimbursements from schools for resupply kits, replacements and breakages; and the provision of kits and printed materials not within the terms of reference of the grant-in-aid from SIDA.

13.2 An analysis of expenditure for the administration of the Project and the amended budget for 1984/85 appear as appendices to this report.

14. Unesco contact.

During late 1982 the Project attracted the attention of UNESCO and the Project Leader was invited to attend the fifth Regional Consultation Meeting of NEIDA (Network of Educ. Innovation for Dev.) held in Kano, Nigeria from 31 January to 4 February. Considerable interest was shown in the Zim-Sci materials exhibited at that meeting and a further invitation was extended by Dr. G. Jokic of the UNESCO Science desk in Dakar to be a member of the Regional Consultative Committee for the Renewal of Science. A meeting was held in Dakar from 21-25 February and the opportunity was taken to present the Zim-Sci project to other members of the committee and members of the UNESCO staff.

14.1 During the same period at the invitation of the Ministry of Education I undertook a tour of Senagalese training institutions and some "écoles superiors" to familiarise French and Senagalese educators with the philosophy and implementation of junior secondary science teaching in Zimbabwe.

14.11 I am very grateful to Professor Yves Quéma, attached to the Ministry of Education, and Dr. Jokic for organising this aspect of my visit to Senegal.

.../19

14.12 While the main purpose of the tour was for me to inform those institutions I visited of Zimbabwean educational developments, I learned much of interest about science education and the educational system of Senegal. I also received a very rapid revision course in my own school derived knowledge of the french language!

14.2 Unesco Sponsored Workshop

A sub-regional workshop sponsored by UNESCO was held in Zimbabwe from the 22-26 August. The worksho, was attended by participants from Botswana, Malawi, Zambia and Zimbabwe. Lesotho and Mozambique were also invited to participate, but unfortunately did not attend.

14.21 The main purpose of the workshop was to acquaint participants with the development methodology and advantages of the Zim-Sci approach to science teaching.

14.22 To this end the programme included small groups sessions in which Zim-Sci type materials were created and produced in limited editions. The result of this work was the production of the following four study guides and teachers guides.

'Bot-Sci' - Water is Life
'Malawi-Sci' - Water Conservation
'Zam-Sci' - What is Energy?
'Zimbabwe-Sci' - Water Pressure

14.23 As a direct result of this workshop the Ministry of Education, Botswana, placed an order for thirty full Form I and Form II kits of Zim-Sci equipment to aid in their planned 1984 secondary school expansion.

14.30 Once again I am grateful to Dr. Jokic of the UNESCO (BREDA) Science desk in Dakar for her energy and enthusiasm which made the sponsorship of this workshop possible.

14.40 The workshop is the subject of a separate report, copies of which are available from UNESCO on request.

15. Other International Contacts

During this year interest in the development of the Zim-Sci Project has grown and we have received many inquiries from all parts of the world. In order to meet this need for information the booklet 'Zim-Sci - An Exciting Experiment' was revised and a fourth edition produced.

15.1 A photographic exhibition illustrating the project was organised by the British Council for the annual Association for Science Education meeting held in Manchester from 2-5 January.

15.11 I was able to attend this meeting and delivered a lecture on the Project to members of the A.S.E. and foreign visitors at the British Council Exhibition.

15.2 Rural Development Technology 1983.

An international conference on appropriate technology was held in Harare from September 12-16. During the course of this conference I presented a paper on the Zim-Sci Project.

15.21 The paper has been published as part of the Conference Report and copies are available from the Conference Organisers.

15.3 Project Leader - University Contact Leave.

I was on 'Contact leave' from the University during October and used the opportunity to meet some of the interest shown in the Project by various institutions in Britain:

15.31 I briefed offices of the British Voluntary Services Overseas on aspects of science teaching in Zimbabwe with particular reference to Zim-Sci.

15.32 I delivered lectures to students and teacher trainers from overseas at the Chelsea Science Centre and the Science Centre of the University of Leeds.

15.33 I met with the moderators of the Associated Examining Board to discuss aspects of the 1984 General Science examination for which it is hoped the majority of Zim-Sci year four pupils will be entered.

15.4 Opportunity was also taken during this visit to Europe to brief SIDA Headquarters staff on the latest position of the project. During this visit discussions were also initiated on the possible use of Zim-Sci materials by SWAPO schools in Namibia.

16. Syllabus Development

When the Zim-Sci Project was initiated it was given the brief of preparing material for the new J.C. science syllabus. This work has now been completed.

16.1 During this period of development the decision was made by the Ministry of Education and Culture to allow all pupils to proceed through to the fourth year of secondary school. This decision implied the production of science materials to meet the needs of Zim-Sci pupils for third and fourth year courses and raised the question of appropriate syllabuses.

16.11 After much discussion with E.O.'s Science SEDU officers, it was decided to adopt the Associated Examinig Board General Science Syllabus as an interim target. The choice was made on consideration of the appropriateness of the syllabus context and the examination format when compared with the Cambridge syllabuses.

16.12 Accordingly, work has begun on the preparation of the 16 units required to cover this syllabus. To date, three units of study guides and teachers guides have been produced and a year III kit introduced into the phased development programme. It is hoped to complete the remaining units by August next year.

16.2 Meanwhile, a syllabus development team under the direction of the Secondary Education Development Unit (SEDU) has been working on a new local syllabus for years III and IV.

16.21 The Zim-Sci team is deeply involved in this project which it is hoped will result in a syllabus with a strong emphasis on applied science and technology appropriate to a broad spectrum of children living in a third world, largely rural, country.

16.22 It is important that when this new syllabus is launched, probably in 1985, materials be available to support it.

Comprehensive support material is particularly vital in this instance because of the radical nature of the new syllabus. Even professional trained science teachers will find the material difficult to teach since it includes aspects of Zimbabwean industry and technology not found in conventional textbooks.

16.23 Accordingly, I intend beginning the development process for new materials in parallel with those for the interim A.E.B. syllabus. This will put considerable strain on the team and I hope the Ministry will be able to expand the writing team in the near future.

17. Publications

The following materials have been by the team since the previous progress report:

17.1 Study Guides Year II

(Each study guide is supported by a corresponding Teachers' Guide.)

Unit G2	Living Things and Their Food.
Unit H1	Forces in Action.
Unit H2	Forces in Living Things.
Unit I1	Understanding Electricity.
Unit I2	Using Electricity.
Unit J	Sense for Senses.
Unit K	Transport Systems in Plants and Animals.

17.2 Sample Revision books III and IV.

17.3 Study Guides Year III (O-Level)

Unit 1	Forces.
Unit 2	Atoms and Molecules.
Unit 3	Energy.

17.4 Reports and Descriptive Papers

Evaluation Report IV	Feedback from Teachers	June 1983 E P Brown (Mimeo)
Zim-Sci	A Review	December 1982 A W Dock (Mimeo)
The Application of the Zim-Sci Methodology to other Areas of the Secondary School Curriculum		December 1982 A W Dock (Mimeo)
A Shift in Emphasis for the Zim-Sci Curriculum from Academic to Applied Science		August 1983 A W Dock (Ministry of Manpower)
Zim-Sci - An Exciting Experiment (Fourth Edition)		
The Zim-Sci Project - An Evaluation		September 1983 Professor S T Bajah International Institute for Educational Evaluation.

18. Conclusion

As stated at the outset of this report I have tried to give a comprehensive 'state of health' description of the Project.

The work of the Project team has attracted world-wide attention in our attempts to meet the need for a truly scientific science curriculum in a third world context.

18.1 The challenge which lies ahead of applying the same methodology to the increasingly complex content of an O-Level curriculum which is itself departing from the conventional approach is a daunting one.

18.2 However, I am confident that given the dedication which the team has shown in the past year, and the freedom and flexibility to create, we can produce a course which will maintain Zimbabwe's position in the forefront of school science curriculum innovation.

A W Dock
PROJECT LEADER ZIM-SCI
December 1983

APPENDICES

1. School statistics growth (by year) 1981 1982 1983 1984
2. Course Certificate.
3. External Evaluation Costs.
4. Ministry of Education Evaluation Objectives.
5. 1983 J.C. Paper.
6. Analysis of Expenditure 1982/83 University of Zimbabwe.
7. Tender Analysis 1983.
8. Annual Budget 1984/85.
9. Circulation of Annual Report .

APPENDIX 1

Growth of the Zim-Sci Project

	1981	1982	1983	1984 (projected)
Form I	465	110	60	100
Form II	-	500	110	60
Form III	-	-	500	110
Form I Resupply Kits	-	500	500	800
Form II Resupply Kits	-	-	500	800

Zim-Sci Schools by Region (1983)

	Year I	Years I + II	Years I + II + III
Harare	10	11	9
Manicaland	7	15	51
Mashonaland	13	15	156
Masvingo	6	9	88
Matabeleland	12	25	73
Midlands	12	27	102

APPENDIX 2

Course Certificate

ZIM–SCI
ZIMBABWE SECONDARY SCHOOL SCIENCE PROJECT

CERTIFICATE

.....

has attended
the 1983
Zim–Sci Annual Refresher Course

Alan W. Dock
Project Leader

APPENDIX 3

Cost of External Evaluation of the Zim-Sci Project

N.B.

The costs of this evaluation which was carried out between July 9 and August 1983, by Professor S Bajah and are therefore not included in the financial statement for this year July 1982 - June 1983.

Return fare Ibadan/Harare	$ 522
'Per diem' 30 days @ $66 per day	$1 980
Honorarium	$1 000
Transport (within Zimbabwe)	$ 400
Typing, stationery and postage	$ 200
Total	$4 102

APPENDIX 4

Agreed Aims For Ministry of Education Evaluation

NATIONAL AIMS

1. To develop a science course to cater for the rapidly expanding secondary school enrolment.
2. To provide a course of studies which caters for the production of a greatly expanded pool of technical/scientific abilities at all levels with an emphasis on the fundamental skills and concepts required for entry into industrial and agricultural training.
3. To reach a balance in science teaching/learning between applied academic science and technical efficiency.
4. To make all secondary school pupils scientifically literate with a range of scientific skills and concepts.

GENERAL AIMS

1. To provide a complete science course based on the Z.J.C. syllabus for the early years of secondary education i.e. pupils above 13 years of age, through the use of specially prepared teachers guides, pupil study guides and comprehensive low-cost science kits for pupils (basic kits) with additional apparatus supplied for the teacher.
2. To emphasise the importance of a practical approach to science through the 'Hands-on' method allowing pupils direct experimentation in pairs, thus providing a balanced course to allow for both the learning and retention of vital information and the opportunity to perform experiments and reach conclusions.
3. To inculcate the compendium of skills involved in isolating variables, proposing hypotheses and designing experiments to test them.
4. To lay down a rational basis for problem solving using a scientific method forthe establishment of an understanding of fundamental scientific concepts.
5. To enable pupils, working in pairs, to progress at their own pace of learning in a mixed ability class.
6. To develop in the pupils, scientific concepts and factual information and progressive training in the writing of reports, using a programmed outline.
7. To provide for a continuous assessment of the learning materials and the efficiency of the system.
8. To use a unit method of approach which allows for a continuous development in a manageable way which provides for syllabus revisions to be accomodated without the total replacement of materials.
9. To plan a programme common to all teachers to enable unqualified science teachers and teachers with little scientific knowledge to competently teach science without the aid of a sophisticated laboratory, through the use of programmed lessons for the teacher, using a step-by-step approach with scripted teacher in-puts, prescribed pupil exercises and follow-up materials.
10. To support the untrained science teacher by providing detailed study guides for pupils and by the provision of suitable in-service programmes and re-orientation courses for such teachers, together with adequate back-up classroom supervision and advice.
11. To design low cost apparatus which includes the use of waste commercial materials and the adaptation to the use of science of low-cost items such as fertilizer measures, tin cans, plaster packets etc.
12. To develop a complete system for the writing, packaging, distribution and evaluation of a 'hands-on' science course.
13. To provide a carefully calculated sufficiency of consumable supplies.
14. To ensure that a working administrative procedure is established for the supply and replacement of ZIM-SCI kits and materials in all Regions to all schools requiring such supplies.

Printed by the Government Printer, Harare.

MINISTRY OF EDUCATION AND CULTURE

ZIMBABWE

ZIMBABWE JUNIOR CERTIFICATE EXAMINATION, 1983

SCIENCE

Time allowed : 2 hours + 15 minutes reading time

TOTAL 100 MARKS

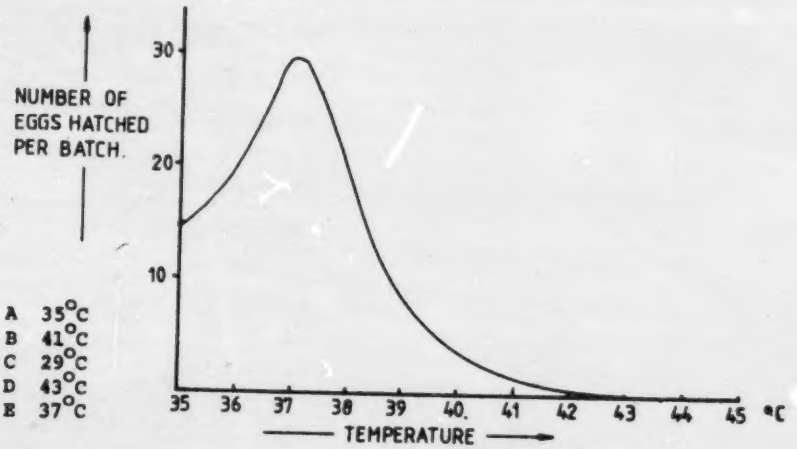
Read the INSTRUCTIONS TO CANDIDATES on the separate ANSWER SHEET provided

PART A

Answer ALL questions

1. Tooth decay in humans is usually started by:
   A bacteria eating the enamel
   B sugar dissolving the enamel
   C acids produced by bacteria
   D eating salty foods
   E enzymes in the saliva

2. Look at the graph below which records batches of eggs hatched at different temperatures. From the graph, which is the best temperature for hatching eggs?



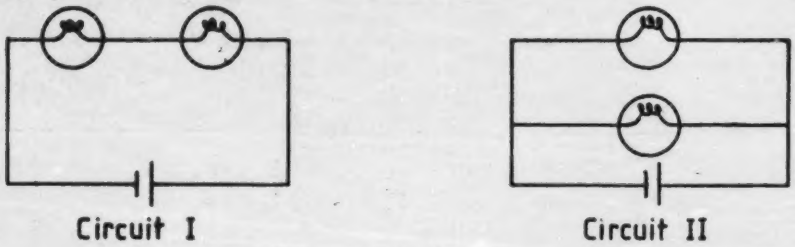
   A 35°C
   B 41°C
   C 29°C
   D 43°C
   E 37°C

3. A pupil used a microscope to examine solid particles suspended in water. The particles seemed to vibrate. This was due to
   A a chemical reaction
   B Brownian movement
   C a convection current
   D diffusion
   E osmosis

4. The upper layers of a soil are usually darker than the subsoil because they contain more:
   a humus
   B clay
   C sand
   D silt
   E water

5. Before the carbohydrates in sadza can enter the human blood stream they must be:
   A pure
   B mixed with salt
   C broken down by bile
   D passed through the large intestine
   E digested

6.

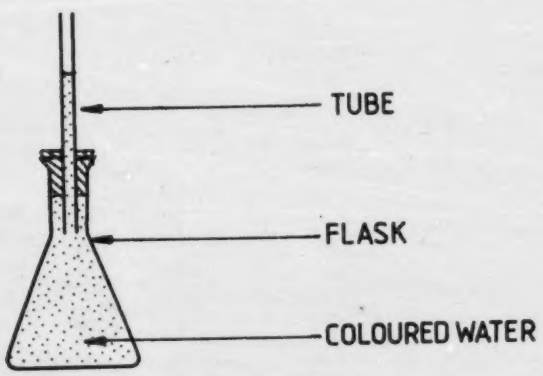


If identical bulbs are connected to identical batteries as shown in the two circuits above then:
   A in both circuits I and II the bulbs will glow with equal brightness
   B the bulbs will glow more brightly in circuit I than in circuit II
   C the bulbs will glow more brightly in circuit II than in circuit I
   D the bulbs will not glow at all in circuit I
   E the bulbs will not glow at all in circuit II

7 The Ear:
   A is an organ for making sounds
   B cannot receive sound unless there is matter between it and the sound source
   C sends sound energy to the brain
   D can only hear sounds that travel through the air
   E shuts itself to sounds by involuntary action

8. A hanging spring without a load is 16 cm long. If a load of 4 kg is hung from the bottom of the spring, it then measures 20 cm long. What would be the length of the spring if a load of 1 kg was hung from it?
   A 17 cm
   B 15 cm
   C 1 cm
   D 21 cm
   E 4 cm

9.



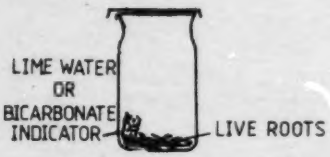
The flask shown above contained coloured water at room temperature. When the flask was placed in hot water the level of the liquid in the tube was observed to fall suddenly and then rise slowly because:
   A the liquid contracted and then expanded
   B the liquid expanded but the flask contracted
   C the flask expanded before the liquid could expand
   D the flask expanded less than the liquid
   E the flask expanded then contracted

10. Which of the following statements are correct about 1 kg of cotton and 1 kg of steel?
   1. A kilogram of steel is heavier than a kilogram of cotton

2. A kilogram of cotton has more volume than a kilogram of steel
3. A kilogram of cotton is denser than a kilogram of steel
4. Their masses are equal

A 1 and 2 only
B 2 and 3 only
C 3 and 4 only
D 1 and 4 only
E 2 and 4 only

11. Jabulani set up the experiment shown in the diagram to find out whether plants respire

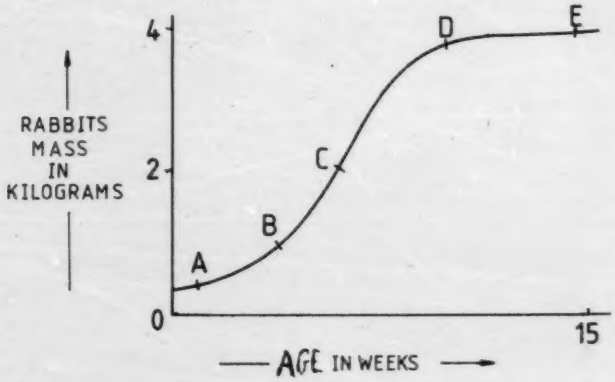


The most suitable control for the experiment would have been

12. The energy used to make the natural water cycle work comes from:

A the sun
B thunder and lightening
C Hydro-electric power
D the wind
E air pressure

13. The graph below shows the growth rate of rabbits reared for meat by a student's co-operative. At what point is it most profitable for the co-operative to kill and sell the rabbits?

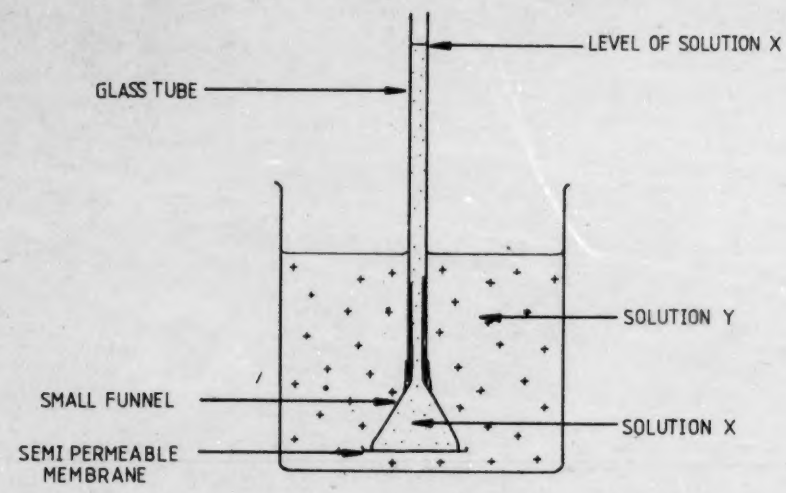


14. Why are very few metals found naturally in the earth in the form of elements?

A metals are not elements because they are too dense
B metals tend to react with other elements in the earth to form compounds
C metals do not have small enough atoms
D metals always join together in activity series
E metals are very scarce in the earth crust

BEST COPY

15.



The diagram shows an OSMOSIS experiment, using two sugar solutions X and Y. After some time the level of solution A in the tube has dropped. This is because

A there has been a rise in the temperature of solution X
B solution X is more concentrated than solution Y
C solution Y is more concentrated than solution X
D there has been a rise in the atmospheric pressure
E the glass tube has contracted

16. All living things are capable of the process of
A photosynthesis
B digestion
C pollination
D respiration
E moulting

17. Which of the following will allow electricity to pass through?
A the "lead" of a pencil
B a drinking straw
C a piece of glass
D a cotton thread
E a rubber band

18. Chipo's mother who is a careless woman, has got sand mixed with her cooking salt. The best way of separating the two will be for her to
A shake the mixture in a bag made of fine cloth
B add enough water to dissolve the sand and then pour it through a piece of cloth
C add enough water to dissolve the salt, pour it through a fine cloth and then leave the salt water in the sun
D set her last born the task of separating out the pieces of sand with a stick
E add enough water, stir thoroughly and leave in the sun.

19. Which is the correct life cycle for most plants?
A fertilization, pollination, germination, adult
B pollination, fertilization, germination, adult
C germination, pollination, adult, fertilization
D adult, fertilization, pollination, germination
E pollination, germination, adult, fertilization

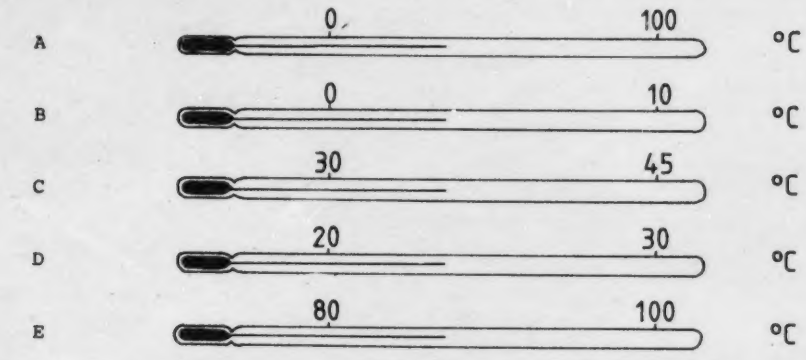
20. George is a growing boy. He can only afford one good meal each day. Which of these meals will provide him with the most balanced meal?
A sadza and meat and an orange and a glass of milk
B sadza and vegetables and fruit and sweets and a soft drink
C sadza and meat and chips and cake and tea
D potatoes and mealie and sausage and sweets and tea
E bread and margarine and banana and coffee

21. An example of osmosis is the process by which:
A carbon dioxide is released to the atmosphere by the lungs

BEST COPY

B water escapes from the leaves of a plant
C a solution of sugar changes to solid sugar
D water enters plant cells
E water condensing on plant leaves

22. Which of the diagrams below shows the correct temperature range for a clinical thermometer?



23. Man belongs to the group of animals called "vertebrates" because:
A he walks upright on two legs
B he has hair on his body
C the female suckles the young
D he has a backbone
E he does not lay eggs

24. An easy way to cool a bottle of milk is to
A Hang it in a tree
B leave it in a bucket full of water
C cover it with a wet cloth inside a closed wooden box
D place it in the sun and wrap it with paper
E place it in the shade outside and cover it with a wet cloth

25. Which of the following statements is FALSE:
A metals are good conductors of heat
B metals are removed from their ores by combining with oxygen
C metals can bend and stretch
D metals are shiny when scratched
E metals can conduct electricity

26. When iron filings were rusted in a measured amount of air, it was discovered that 1/5 of the volume of air was used up. This was because
A air contains 20% oxygen
B 20% carbon dioxide was released
C iron filings used up only 1/4 of the nitrogen available
D air combines with the iron filings to produce sulphur
E 20% of the air is made up of compounds

27. The amount of light entering the eye is controlled by the
A lens
B retina
C iris
D cornea
E rods and cones

28. Pollination is
A the joining of a male sex cell with a female sex cell
B the process in which pollen reaches the stigma
C the process in which pollen is collected by insects
D the process in which a pollen grain sends out a pollen tube to the ovary of a flower
E the blowing of pollen by the wind

29 Which one of these is NOT a form of energy?
A heat
B light

BEST COPY

C sound
D matter
E electricity

30. Which of the following statements about muscles is FALSE:
A muscles work in antagonistic pairs
B muscles are mainly made of protein
C muscles are attached to the bone by a tendon
D muscles only do work by contracting
E muscles expand by less than ⅓ of their length

31. In which of the following is a chemical reaction taking place?
A A piece of paper burning
B clothes drying on a line
C a crystal forming in a beaker
D a nail being magnetised
E sugar dissolving in tea

32. An iron nail is put into copper sulphate solution. After a while the nail
A becomes coated with copper metal
B is much clearer than before
C turns blue because the solution is also blue
D becomes coated with the sulphate from the solution
E becomes rusty

33. An example of a voluntary action is
A breathing
B coughing
C chewing
D sneezing
E shivering

34. Which of the following dams is likely to lose most water by evaporation during the dry season?

Dam	Surface area of dam	Average depth of water in dam	Aver. dry season air temp. in dam's neighbourhood
A	15 ha	10 m	16°C
B	10 ha	8 m	15°C
C	30 ha	10 m	16°C
D	100 ha	12 m	18°C
E	100 ha	11 m	14°C

35. When you rub hands together what energy changes take place?
A chemical → sound → kinetic and heat
B chemical → kinetic → heat and sound
C heat → potential → kinetic and chemical
D sound → kinetic → heat and chemical
E kinetic → sound → chemical and potential

36. A boy puts grease on the rims of his bicycle wheels. This is
A a good idea because it will prevent the rims becoming rusty
B a good idea because it will reduce the noise when the brakes are applied
C a poor idea because grease will cause the brake blocks to perish
D a poor idea because it will reduce friction and thus reduce the effectiveness of the brakes
E a good idea because it will cut down friction and the bicycle will then go faster

37. The leaf in the diagram was picked outside at mid-day and then tested for starch using iodine solution. Part X turned blue-black and Part Y went pale yellow. Which of the following explanations is TRUE?
A part Y received no carbon dioxide
B part Y contains starch
C part X received no light
D part X cannot photosynthesise
E part Y has no chlorophyll

X = GREEN
Y = WHITE

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38. The filament (very thin wire) in a torch bulb gets hot and produces light because
    A the filament is surrounded by glass
    B the bulb is in the front of the torch
    C the filament is a good conductor of electricity
    D there is no insulation on the filament
    E the filament offers resistance to the current

39. Tendai decides to use a wheelbarrow to move a large stone. By using a wheelbarrow instead of lifting the stone in his arms and walking with it he uses
    A less energy but has to work harder
    B more energy but the work is easier
    C the same amount of energy but the work is easier
    D less energy and the work is easier
    E more energy and works harder

40. The fact that a very tiny piece of colouring material can colour a large quantity of water shows that the molecules of the colouring material:
    A are more numerous than those of water
    B are the same size as those of water
    C are bigger than those of water
    D attract those of the water
    E must be very small

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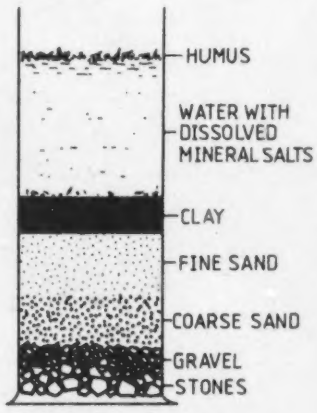
PART B

Answer THREE questions only

You are advised to read through ALL the questions carefully before you choose three to answer. You are given 15 minutes extra time to do this.

1. (a) The diagram opposite shows the main parts of a sample of soil which has been vigorously shaken with water and then allowed to stand.



(i) Why has the soil settled out into the order shown in the diagram? (1)

(ii) In a fertile soil there are always at least two other things present which you cannot see in the diagram. What are they? (2)

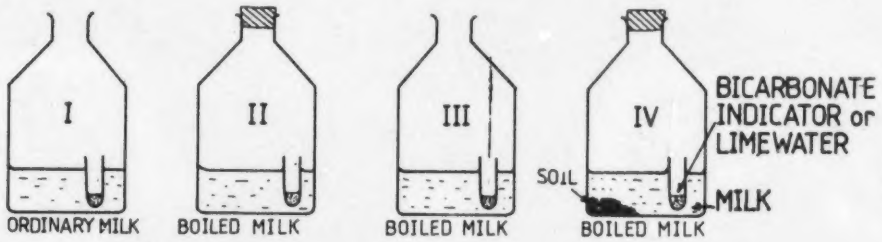
(iii) What is humus (1)

(iv) Why is humus important in fertile soil? (2)

(v) State two disadvantages of a sandy soil. (2)

(vi) State two useful functions of worms and other animals which live in the soil? (2)

(b) A class decided to investigate why milk goes sour. They set up the experiments shown in the diagram.



Bottle No. I they put ordinary milk and left the top open.
Bottle No. II they put milk which had been boiled for ten minutes, allowed to cool and the top closed.
Bottle No. III they put milk which had been boiled for ten minutes, allowed to cool and the top left open.
Bottle no. IV they put milk which had been boiled for ten minutes, allowed to cool, some soil added and then the top was closed.

After a few days they observed:
the milk in bottle No. I had turned sour.
the milk in bottle No. II had NOT turned sour.
the milk in bottle No. III had turned sour.
the milk in bottle No. IV had turned sour.

In bottles numbers I, III and IV the limewater or bicarbonate indicator had changed showing the presence of carbon dioxide.

(i) What does the appearance of carbon dioxide tell you? (1)
(ii) What do you think caused the milk to go sour? (2)
(iii) Give two pieces of evidence from the experiment which helped you to decide your answer to (b) (4)
(iv) What advice would you give your mother on how to keep milk fresh without a refrigerator? (3)

2. Some students carried out an investigation of the feeding relationship of animals on a farm. The farm had cattle, rabbits, fields of grass and cabbage plots, and was often visited by jackals. The class of students observed the following:
   (a) The farmer and his family ate cabbage and meat from cattle and rabbits.
   (b) The rabbits were fed on grass and cabbages.
   (c) The cattle fed on the grass only.
   (d) The jackals fed on the rabbits.

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From the above observations:

A. Construct:

(i) two food chains which include a producer and a herbivore. (4)
(ii) a food chain including a producer, a primary consumer and a secondary consumer. (2)
(iii) a food web in which all the organisms observed are included using arrows to show the direction of the energy flow. (6)

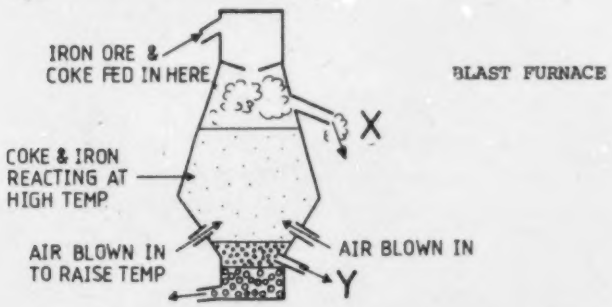
B. Answer the questions:

(i) Which of the above living thins are omnivores? (1)
(ii) Which one of the animals above would you expect to have strong pointed canine teeth? (2)
(iii) Which one of the animals above would you expect to have large incisor teeth? (2)

C. What would happen if the rabbits were all killed by pollution for instance by the misuse of insect killing sprays? (3)

3. (a)

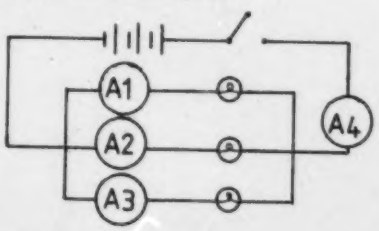
(i) State 2 differences between compounds and mixtures. (2)
(ii) Describe how you would separate a mixture of Iron filings and powdered sulphur. (3)
(iii) Describe how you would make a compound with Iron and Sulphur in it. (3)
(iv) What is the name of this compound? (1)
(v) Write out, as a "chemical sentence" or as an equation, the reaction between Sulphur and Iron. (2)



3. (b) The diagram shows a blast furnace. Iron ore and coke are fed in at the top. Streams of air are blown in from below to raise the temperature so that reaction takes place. Molten iron is drawn of at the base of the furnace.

(i) What is the chemical name for the iron ore that reacts with the coke? (1)
(ii) What chemical in the coke is reacting with the iron ore? (1)
(iii) Describe the reaction that takes place within the blast furnace either as a "chemical sentence" or an equation. (2)
(iv) What kind of reaction is this? (1)
(v) Name the two substances that come out of the furnace at X and Y on the diagram. (2)
(vi) What is this impure iron called? (1)
(vii) What can it be used for? (1)

4. The circuit shows three identical bulbs connected in parallel.



(a) If A_1 reads 0,2 A what will be the reading on A_2, A_3 and A_4? (3)
(b) Draw the diagram again with an extra switch which will switch off bulb Z but not the other two. (1)
(c) What would happen to the bulbs if a very long thin piece of wire was connected between the battery and the bulbs? (2)
(d) If the batery is delivering 24 joules per second what do you think is the power of each of the bulbs? (2)
(e) A student measures the power of each bulb and finds he gets a smaller answer than that of (d). Where do you think the lost power is going? (2)

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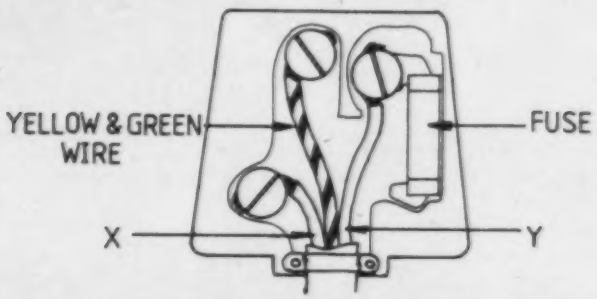
ELECTRICITY

The diagram below shows a three-pin, fused plug.



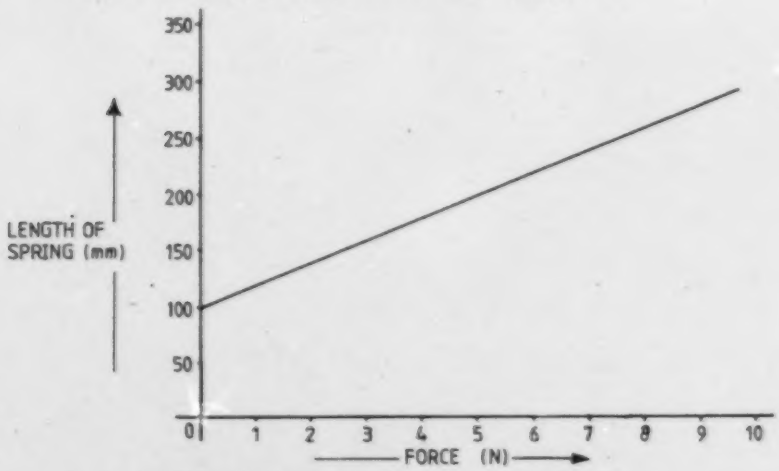
(i) What are the colours of the wires X and Y? (2)
(ii) From which wire or wires would you receive a shock if it were plugged in with the back removed? Give the reason for your answer. (2)
(iii) Explain the function of the green and yellow wire. (3)
(iv) Which of the following fuses: 2A, 5A or 13A should be fitted to the plug if it is to be used for:
(a) an electric light of 60 W (1)
(b) a stove of 5 000 W (1)
(c) what is *inside* the fuse? (1)

5. N.B. The force of gravity may be taken to be 10 Newtons per kilogram.

(a) Some form II pupils measured the force needed to pull a block of iron across their desk. They found the force to be 0,5 N
(i) Describe two ways in which they might make the force needed smaller. (2)
(ii) Briefly wxplain whythe engine of a car is filled with oil. (2)

(b) A man loads 15 bags of mealie meal each with a mass of 20 kg from the ground into a cart. The height of the cart off the ground is 1,5 m.
(i) How much useful work has he done? (2)
(ii) If the loading took 1½ minutes, what was his power output during that time? (2)
(iii) What other work will he have done in the same time? (1)

(c) The graph shows the length of a spring as various size forces are applied to it.



(i) What was the original length of the spring? (1)
(ii) What is the length of the spring if a force of 5 N is applied to it? (1)
(iii) What would be the approximate mass of an object which caused the spring to stretch to a length representing a force of 10 N? (2)
(iv) If the force on the spring was made very large what will happen to it? (1)

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(d) The diagram shows some of the muscles which move the arm.

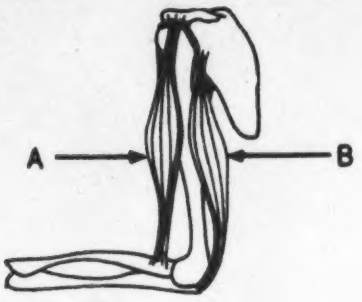
(i) Is the force created by the muscles bigger or smaller than the force of gravity on an object held in the hand? (1)

(ii) When the arm lifts which muscle is converting chemical energy to force and work? (1)

(iii) What is the other muscle doing? (1)

(iv) How does the chemical energy reach the muscles? (1)

(v) Why is it better for a runner to eat glucose before a race instead of bread? (2)



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APPENDIX 6

STATEMENT OF EXPENDITURE AGAINST THE ZIM-SCI ADMINISTRATION VOTE HELD AS VOTE NO 2.24001 - 5 IN THE UNIVERSITY OF ZIMBABWE FOR THE FINANCIAL YEAR 1 JULY 1982 - 30 JUNE 1983.

Overall summary of votes:

2.240.2	Salaries	32373.06
2.240.3	Secretarial Assistance	5624.02
2.240.4	Travel/Courses	4551.24
2.240.5	Development, research, stationery, postage, etc.	3763.18
		46 311.50

"Functional" Analysis

1. Project Leader and writers	(salaries)	18 458.96*
2. Administration	(salaries)	7 396.60
3. Secretarial	(salaries)	7 938.52
4. Evaluation	(salaries)	1 407.00
5. Development, materials & research		1 051.04
6. Art Work		2 993.50
7. Travel (courses & school visits)		3 216.33
8. Travel (local)		1 334.91
9. Postage & Stationery		1 926.85
10. Duplicating Services		476.28
11. Telephone & Telex services		111.51
		46 311.50

*Project Leader's salary added to the vote from 1.1.83

APPENDIX 7

TABLE I. OVERALL ANALYSIS : 1983 TENDER FOR EQUIPMENT 1984.

SUCESSFUL TENDER	FORM 1 KIT	FORM 11 KIT	FORM 111 KIT	FORM 1 RESUPPLY KIT	FORM 11 RESUPPLY KIT	T.RECORDER	CASSETTES	TOTAL
Protea	8 844.00	828.00	2 312.10	53 728.00	-	-	-	65 712.20
Banta	17 257.81	7 406.25	21 321.58	-	-	-	-	45 985.64
McDonald	60 727.70	2 479.14	2 469.24	-	38 400 ±	-	-	104 076.08
Myta	460.00	3 228.48	4 092.00	-	-	-	-	7 780.48
Comspec	6 020.00	16 656.00	8 470.00	-	-	-	4 000	35 146.00
W.R.S.	19 779,00	40 728,00	12 364,00	-	-	33 950.00	-	106 821.00
T.L.	-	-	-	-	-	-	-	-
TOTAL	113 088.51	71 325.87	51 029.02	53 728.00	38 400	33 950.00	4 000	365 521.40

Foreign currency component of Zim-Scl marelals is approximately 38% of total.

TABLE II. COST PER KIT : (1983 TENDER FOR EQUIPMENT 1984)

FORM	COST
I	1 130.89
II	1 188.76
III	463.90
1 (RS Kit)	67.16
II (RS Kit)	60.12
T.RECORDER	48.50
CASSETTES	0.40

TABLE III. PERCENTAGE DISTRIBUTION OF COSTS : (1983 TENDER FOR EQUIPMENT 1984)

FORM	% OF TOTAL COST	
I	30.94	31
II	19.51	20
III	13.96	14
I RS Kit	14.70	15
II RS Kit	10.51	11
T.Recorder	9.29	9
Cassettes	1.09	1

Appendix No. 8

Revised Budget 1983/1985

N.B. Because of the projected introduction of a new O-level Science syllabus in 1985, the development of the materials for the current syllabus has been restricted to the Year III kit and the sixteen units of study materials required to cover the course. It is anticipated that during 1984 work will begin on the design of 'conversion kits' for the new Year III, new Year IV kits and new O-level study materials.

This strategy is reflected in these modified budget projections. Other modifications have occurred as a result of the inclusion of actual prices and changed demands.

This budget analysis is for the kits and other study materials. It does not include the $73 000 administered annually through the University of Zimbabwe for 'Research, Development, Evaluation and Training. (See appendix 6)

Financial Year:	1983/1984		1984/1985	
Course Year	Item	Cost $	Item	Cost $
Year I	100 kits @ 1130.89 ea.	113 089.00	70 kits @ 1300 ea.	91 000.00
	800 resupply kits @ 67.16 ea.	53 728.00	800 resupply kits @ 70 ea.	56 000.00*
	Printed material, new editions A_1 to E_2.			
	8 study guides x 30 000 @ 20c	48 000.00		
	8 teacher guides x 3000 @ 20c	4 800.00		
Year II	60 kits @ 1188.76 ea.	71 315.60	100 kits @ 1300 ea.	130 000.00
	800 resupply kits @ 60.12	48 096.00	800 resupply kits @ 65	52 000.00*
Year III	110 kits @ 463.90 ea.	51 029.00	100 kits @ 500	50 000.00
	Additional basic kits @ 7 ea.	85 400.00	600 'conversion kits' @ 200 ea.	120 000.00
	Printed materials, O-level Units 1-16 x 70 000 @ 30c ea.	336 000.00	Printed materials <u>new</u> O-level Units N_1 to N_4 70 000 @ 35c ea.	98 000.00
	Units 1-16 Teacher Guides 3000 @ 35c ea	16 800.00	Teacher Guides for above, 3000 @ 40c ea.	4 800.00
	700 Audio cassette players @ 48.50 ea.	33 950.00	800 resupply kits @ 40 ea.	32 000.00 *
	4 Audio cassettes x 700 @ 40c ea.	1 120.00		
Year IV	Nil.		600 <u>New</u> O-level kits @ 600 ea.	360 000.00
			Printed materials New O-level Units N_5 to N_8 70 000 @ 35c ea.	98 000.00
			Teacher Guides for above, 3000 @ 40c ea.	4 800.00
			4 Audio cassettes x 800 @ 40c ea.	1 280.00
Totals		863 337.60		1 045 880.00
Previous Budget Totals		(1 298 440)		(856 265)

* Cost of these items it is hoped, will be recoverable from schools

A. W. Dock,
Project Leader.

APPENDIX 9

Circulation of Annual Report

Audio Visual Services
Archives
Associated Examination Board
British Council
Bulawayo Public Library
Cambridge Board
ERIC

Ministry of Education:

Minister
Deputy Minister
Secretary
Deputy Secretary (Secondary)
C E O Planning
C E O SEDU
Deputy C E O SEDU
C E O Standards Control
C Ex O Supplies Branch
C Ex O Finance
Library
Gweru Teachers Training College
Bulawayo Teachers Training College
Belvedere Teachers Training College
UNESCO Desk.
SIDA
UNESCO (Dakar)

University of Zimbabwe:

Vice Chancellor
Pro Vice Chancellor
Registrar
Dean of Education
Chairman of Curriculum Studies
Library.
Zim-Sci Team